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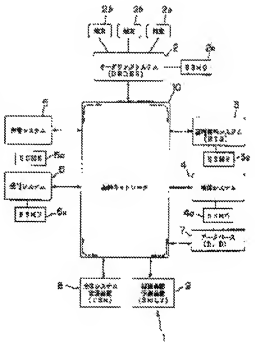
(54) PROCESSING TIME PREDICTION SYSTEM FOR HOSPITAL JOB

(57)Abstract:
PURPOSE: To provide the time prediction system for a hospital job capable of accurately grasping the congestion conditions of the hospital job and obtaining the processing time required for examination or the like beforehand.
CONSTITUTION: A hospital information system 1 is composed of plural sub systems provided for respective job departments inside a hospital (an ordering system 2, a radiology department 3, a species of examination 4, accounting 5 and reception 6), a data base device 7 for preserving and managing patient information or the like, an entire system management device 8 for managing information relating to the state of the entire system or the like and a processing time prediction device 9 for holding a time prediction model beforehand and predicting the processing time. The respective components are mutually communicably connected through a basic network 10. The respective sub systems 2-6 are composed of plural terminals (the terminal 2b inside the ordering system 2 for instance) and sub system management devices 2a-6a for managing the information relating to operation states inside the respective sub systems or the like and are mutually communicably connected through a branch network.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] In the system which is equipped with two or more elements which can output and input the operating information about each of two or more work assigned according to the work breakdown of a hospital, connects each of two or more of these elements mutually possible [a communication link], and managed the above-mentioned operating information A system management means to manage the information about the employment condition of the above-mentioned system of the above-mentioned operating information which includes the information on processing of two or more above-mentioned work, and management at least, The information on the above-mentioned processing managed by this system management means and management is applied to at least one time amount predictive model currently held beforehand. The processing-time prediction system of the hospital business characterized by having a processing-time prediction means to predict the time amount to be required by the time of processing termination from the time of demand generating when requiring processing of the above-mentioned work newly.
[Claim 2] Said processing-time prediction means is the processing-time prediction system of the hospital business according to claim 1 which it is built corresponding to said time amount predictive model. and is a parameter adjustable algorithm, and is equipped with a means to set up the information on said processing and management as the parameter.
[Claim 3] The information on said processing and management is the processing-time prediction system of the hospital business containing the number of demands which is in each demand incidence rate, the demand processing time, and the waiting state of work of said plurality at least according to claim 2.
[Claim 4] Said time amount predictive model is the processing-time prediction system of the hospital business according to claim 3 which is a model based on a queuing network at least.
[Claim 5] Said two or more elements are the processing-time prediction systems of the hospital business according to claim 4 which contains a terminal unit at least.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the processing-time prediction system of hospital business, especially manages the operating information on each work, such as medical examination of hospital business, inspection, reception, and accounting, and relates to the processing-time prediction system which applied this operating information to the time amount predictive model.
[0002]
[Description of the Prior Art] There are usually medical examination carried out by the medical practitioner in a consultation room etc. and business carried out by each specialized staff etc. in each section, such as reception, various inspection, drugs, and accounting, in order to assist this medical examination as business of a hospital. The various information about medicine is transmitted between each of two or more of these operating sections. Generally as a system related to the hospital business for transmitting such information quickly and correctly, the HIS (HIS) is known.
[0003] This HIS consists of two or more terminals which bear I/O of medical information, and each of this terminal is mutually connected possible [a communication link] through the network as an information-transmission way. Moreover, each of this terminal is installed in each operating section, such as reception of a hospital, a consultation room, various laboratories, and accounting, as an I/O device of various medical information.
[0004] Among the various medical information outputted and inputted from two or more above-mentioned terminals, the request information of the request of the request to a consultation room from reception, the inspection request to various laboratories [medical practitioner / of a consultation room], drugs preparation, etc. will be sent to the terminal of trustee business (inspection etc.) through a network by being inputted from the terminal of requesting agency business (medical examination etc.). This transmitted request information includes the contents which direct the work breakdown of a trustee concretely, for example, an inspection class etc., and these contents will be displayed on the screen of the terminal of a trustee. Thereby, at a trustee, while processing inspection etc. in accordance with the contents of a request by which a screen display was carried out to the terminal, it returns to the terminal of a requesting agency through a network by inputting the information on this carried-out processing result from a terminal.
[0005] Here, the outline in the case of carrying out an inspection request is explained to the radiology section which bears various image inspection from the medical practitioner of a consultation room as an example of the above-mentioned request signal transduction.
[0006] First, if a medical practitioner inputs an inspection request of a patient into a terminal, this request information will be sent to radiology through a network. At this time, a medical practitioner judges whether based on confusion situations, such as a waiting state of the patient in a trustee, and the unsettled number of requests, the time amount from which an inspection result is obtained is expected experientially, this anticipation time amount is considered, and it is urgently made a request, or it is usually made a request.
[0007] Subsequently, in radiology, if arrival of a patient is checked and reception of a patient is performed, image inspection by the radiology engineer will be carried out. This image inspection is conducted according to the inspection class of the request information, the contents of inspection, etc. This inspection result is sent to the terminal of a radiology interpretation-of-radiogram room with request information. At this time, the name of patient of the inspection information, an inspection class, the contents of inspection, etc. are sent also to the terminal of accounting.
[0008] Subsequently, at a radiology interpretation-of-radiogram room, the interpretation of radiogram of the

inspection result is done by the radiogram-reading doctor, and this interpretation-of-radiogram result is summarized as an interpretation-of-radiogram report. The interpretation-of-radiogram information on this interpretation-of-radiogram report is sent to the terminal of a requesting agency through a network with inspection information from the terminal of radiology. At this time, the inspection fee is calculated at the terminal of accounting based on the above-mentioned inspection information.

[0009] Subsequently, in a requesting agency, a sick diagnosis of the patient by the medical practitioner and a therapy are performed based on the inspection information and interpretation-of-radiogram information which have been sent from radiology.

[0010]

[Problem(s) to be Solved by the Invention] However, since the operating information about medicine, such as an inspection request, was transmitted to each of two or more operating sections not through a help but through a network in the HIS of the conventional technique mentioned above, it was difficult to grasp the confusion situation in another operating section, i.e., the unsettled number of requests which changes with time, a patient's waiting state, etc.

[0011] If it was in the HIS synthesizing various medical information when the above-mentioned confusion situation consisted of two or more processings especially for example, for a certain reason, it was very difficult for a confusion situation to occur in each of two or more processings to grasp each of this confusion situation correctly.

[0012] As mentioned above, although it was difficult to grasp the confusion situation of another operating section, the medical practitioner needs to grasp the confusion situation of trustee business as much as possible, in order to judge whether it is usually made a request or it is urgently made a request, and needed to expect the time amount which work of trustee business takes. For example, since a medical practitioner was not able to recognize the confusion situation of trustee business, namely, was hardly able to expect end time of work of trustee business, even if he usually actually issued the request, he might take out the request also with the time of the confusion situation which is generous enough in time urgently.

[0013] When the above-mentioned unnecessary urgent request arose, while the operation effectiveness of the HIS fell, there was a trouble that the working capacity of trustee business will also fall, consequently a patient's diagnostic effectiveness etc. will fall.

[0014] Moreover, it was set to one [as opposed to / for a patient / inspection] of the sources of anxiety that the time amount which inspection takes is unknown.

[0015] This invention aims at offering the time amount prediction system of beforehand acquirable hospital business for the processing time which inspection etc. takes while it was made in consideration of the problem of the conventional technique mentioned above and can grasp the confusion situation of hospital business correctly.

[0016]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, the processing-time prediction system of the hospital business concerning invention according to claim 1 It has two or more elements which can output and input the operating information about each of two or more work assigned according to the work breakdown of a hospital. Connect each of two or more of these elements mutually possible [a communication link], and it considers as the configuration which managed the above-mentioned operating information. A system management means to manage the information about the employment condition of the above-mentioned system of the above-mentioned operating information which includes the information on processing of two or more above-mentioned work, and management at least, The information on the above-mentioned processing managed by this system management means and management was applied to at least one time amount predictive model currently held beforehand, and it has a processing-time prediction means to predict the time amount to be required by the time of processing termination from the time of demand generating when requiring processing of the above-mentioned work newly.

[0017] Moreover, in invention according to claim 2, said processing-time prediction means was built corresponding to said time amount predictive model, and is a parameter adjustable algorithm and is equipped with a means to set up the information on said processing and management as the parameter.

[0018] Moreover, in invention according to claim 3, the information on said processing and management contains the number of demands which is in each demand incidence rate, the demand processing time, and the waiting state of work of said plurality at least.

[0019] Moreover, in invention according to claim 4, said time amount predictive model is a model based on a queuing network at least.

[0020] Moreover, in invention according to claim 5, said two or more elements contain the terminal unit at least.

[0021]
[Function] If it is in invention according to claim 1, while the information about the employment condition of the system of the operating information which includes the information on processing of two or more above-mentioned work and management at least is managed by the system management means By the processing-time prediction means, the information on processing and management is applied to at least one time amount predictive model currently held beforehand, and the time amount to be required by the time of processing termination from the time of demand generating when requiring processing of work newly is predicted.
[0022] Moreover, in invention according to claim 2, it is built corresponding to the above-mentioned time amount predictive model, and the information on processing of two or more work and management is set up as the parameter by the processing-time prediction means as a parameter adjustable algorithm.
[0023] For example, in invention according to claim 3, the information containing the number of demands in each demand incidence rate, the demand processing time, and the waiting state of two or more work is set up as a parameter of the above-mentioned time amount predictive model.
[0024] Moreover, in invention according to claim 4, the model based on a queuing network is beforehand held as one of the time amount predictive models.
[0025] Moreover, in invention according to claim 5, operating information is outputted and inputted among two or more elements which contain a terminal unit at least.
[0026]
[Example] Hereafter, one example of this invention is explained with reference to drawing 1 - drawing 7 . In addition, this one example carries and carries out the time amount prediction system of the hospital business concerning this invention to the HIS.
[0027] Two or more subsystems 2--6 with which HIS 1 shown in drawing 1 is formed in each of the operating section in a hospital, The database equipment 7 which saves patient information etc. and is managed, and the whole system management equipment 8 which constitutes a part of system management means of this invention (TSM), It consists of processing-time prediction equipment (it is also called a simulator (SMLT)) 9 which constitutes the processing-time prediction means of this invention, and each of this component is mutually connected possible [a communication link] through the trunk-line data service networks 10, such as LAN.
[0028] A subsystem 2--6 consists of the order ring system 2 which manages a patient's clinical information, the radiology system 3 which manages a patient's image inspection information, a specimen system 4 which manages a patient's laboratory test information, an accounting system 5 which manages the accounting information in a hospital, and a reception system 6 which manages an outpatient's reception information etc.
[0029] Each of this subsystem 2--6 consists of two or more terminals connected to the network for subsystems, such as LAN, (it is hereafter called a branch line network), and the subsystem management equipment (SSM) as an important section of the system management means of this invention (refer to drawing 2).
[0030] The order ring systems 2 are two or more terminal 2bs which are the systems which manage a patient's clinical information and take out directions of an inspection request etc. to each operating section, and are arranged in a consultation room, a ward, etc. -- It consists of 2b and subsystem management equipment (SSMO) 2a which supervises the information about the employment condition of this system 2 etc. another component connected to a trunk-line data service network 10 through the gateway for communications protocol conversion (not shown) while each of this component is mutually connected possible [a communication link] through the branch line network (not shown) -- respectively -- ** -- it can communicate mutually.
[0031] Two or more terminal 2bs -- Each of 2b consists of hardware, such as CPU which is not illustrated, memory, stores (a magnetic disk, optical disk unit, etc.), and an interface. By this hardware configuration, it is terminal 2b. -- Each of 2b has come to be able to carry out a screen display to terminal [which sends directions of an inspection request, such as a laboratory test and image inspection, to the subsystem of a trustee through a trunk-line data service network 10 from terminal 2b of arbitration] 2b which both received this request result and inputted directions by alter operation, such as a medical practitioner or a nurse. Moreover, terminal 2b -- When a medical practitioner etc. issues directions of an inspection request, each of 2b receives the prediction result of this inspection end time, and has come to be able to carry out a screen display to terminal 2b which carried out the directions input by sending directions of a time amount prediction demand to time amount prediction equipment 9 through a trunk-line data service network 10.
[0032] Subsystem management equipment (SSMO) 2a consists of hardware, such as CPU which is not illustrated, memory, stores (a magnetic disk, optical disk unit, etc.), and an interface. By this hardware configuration, subsystem management equipment 2a The condition of the demand directed through a trunk-line data service

network 10, terminal 2b in the order ring system 2 -- While supervising the employment condition of the system 2 which changes every moment with time [a processing state including each input of 2b, operation / failure situation, etc.] When there is a demand of reference etc. to the information about the employment condition of this system 2 from each of all the components connected to a trunk-line data service network 10, it answers information about employment condition of system in this time demand-origin.

[0033] The radiology system 3 is two or more terminal 3b usually arranged at a radiology reception room, an image laboratory, an interpretation-of-radiogram room, etc. as it is the system which manages the text about image inspection carried out by various kinds of image diagnostic equipment (an X-ray CT scanner, MRI equipment, etc.) of radiology and is shown in drawing 2 . -- It consists of 3b and subsystem management equipment (SSMR) 3a which manages the information about the employment condition of this system 3 etc. Each of this component can communicate to each of all the components connected to a trunk-line data service network 10 through gateway 3d for communications protocol conversion, and mutual while connecting mutually possible [a communication link] through branch line network 3c.

[0034] A terminal is 3b respectively. -- 3b consists of hardware, such as CPU which is not illustrated, memory, stores (a magnetic disk, optical disk unit, etc.), and an interface. By this hardware configuration, it is terminal 3b. -- If directions of an image inspection request are received from terminal 2b of the arbitration in the order ring system 2, each of 3b will return information, such as an operation result of directed image inspection, and an interpretation-of-radiogram result, to terminal 2b of the request origin in the order ring system 2 through a trunk-line data service network 10 by actuation of a radiology medical practitioner or the staff while it displays the contents of an inspection request on a screen.

[0035] This terminal 3b -- If an example of each arrangement configuration of 3b is explained, by terminal 3b arranged at a radiology reception room, the screen display of the contents of an inspection request directed from terminal 2b of the arbitration in the order ring system 2 and registration of a candidate patient's patient information will mainly be performed first. Moreover, in terminal 3b of an image laboratory, while carrying out a screen display of the patient information registered at the terminal of the contents of an inspection request, and a radiology reception room by actuation of the radiology engineer who carries out image inspection, an inspection implementation result can be inputted. Furthermore, in terminal 3b of an interpretation-of-radiogram room, while carrying out a screen display of the inspection implementation result inputted in the contents of an inspection request, patient information, and an image laboratory by actuation of the medical practitioner who performs the interpretation of radiogram, the interpretation-of-radiogram result of the medical image obtained by image inspection can be inputted.

[0036] Subsystem management equipment (SSMR) 3a consists of hardware, such as CPU which is not illustrated, memory, stores (a magnetic disk, optical disk unit, etc.), and an interface. By this hardware configuration, subsystem management equipment 3a Terminal 3b in the condition of the demand directed through a trunk-line data service network 10, and this system 3 -- While supervising the employment condition of the system 3 which changes every moment with time [a processing state including each input of 3b, operation / failure situation, etc.] When there is a demand of reference etc. to the information about the employment condition of this system 3 from each of all the components connected to a trunk-line data service network 10, it answers information about employment condition of system at this time demand-origin.

[0037] The specimen system 4 is a system which manages a patient's laboratory test information, and consists of two or more terminals (not shown) arranged at a laboratory test room etc., and subsystem management equipment (SSMC) 4a. Each of this component can communicate to each of all the components connected to a trunk-line data service network 10 through the gateway for communications protocol conversion (not shown), and mutual while connecting mutually possible [a communication link] through the branch line network.

[0038] Each of a terminal consists of hardware, such as CPU which is not illustrated, memory, stores (a magnetic disk, optical disk unit, etc.), and an interface. Information, such as an operation result of the laboratory test directed by this hardware configuration while displaying the contents of an inspection request on the screen by the staff's etc. actuation when each of a terminal received directions of a laboratory test request from terminal 2b of the arbitration in the order ring system 2, is returned to terminal 2b of the request origin in the order ring system 2 through a trunk-line data service network 10.

[0039] Subsystem management equipment (SSMC) 4a consists of hardware, such as CPU which is not illustrated, memory, stores (a magnetic disk, optical disk unit, etc.), and an interface. By this hardware configuration, subsystem management equipment 4a While supervising the employment condition of the system 4 which changes every moment with time [the condition of the demand directed through a trunk-line data service network 10, a

processing state including each input of the terminal in the specimen system 4, operation / failure situation, etc.] When there is a demand of reference etc. to the information about the employment condition of this system 4 from each of all the components connected to a trunk-line data service network 10, it answers information about employment condition of system at this time demand-origin.

[0040] An accounting system 5 is a system which manages the accounting information in a hospital, and consists of two or more terminals (not shown) arranged at an accounting room etc., and subsystem management equipment (SSMK) 5a. Each of this component can communicate to each of all the components connected to a trunk-line data service network 10 through the gateway for communications protocol conversion (not shown), and mutual while connecting mutually possible [a communication link] through the branch line network. This accounting system 5 can calculate tariffs, such as an inspection fee, now from operation information, such as various inspection sent through a trunk-line data service network 10.

[0041] The reception system 6 is a system which receives an outpatient, and consists of two or more terminals (not shown) arranged at outpatient department reception etc., and subsystem management equipment (SSMU) 6a. Each of this component can communicate to each of all the components connected to a trunk-line data service network 10 through the gateway for communications protocol conversion (not shown), and mutual while connecting mutually possible [a communication link] through the branch line network (not shown). This reception system 6 sends reception information, such as an outpatient, to order ring system 2 grade through a trunk-line data service network 10.

[0042] Database equipment 7 consists of hardware, such as CPU which is not illustrated, memory, stores (a magnetic disk, optical disk unit, etc.), and an interface, and is connected to each of all the components connected through a trunk-line data service network 10, and mutual possible [a communication link]. By these configurations, proper medical information, such as patient information (a name of patient, sex, etc.) treated within HIS 1, is saved, and this database equipment 7 can manage it now. Moreover, if the demand of referenee etc. is received from each of the above-mentioned component connected to a trunk-line data service network 10, this database equipment 7 will answer this demand, and will return reference information to each of the above-mentioned component of a requiring agency.

[0043] whole system management equipment 8 consists of hardware, such as CPU which is not illustrated, memory, stores (a magnetic disk, optical disk unit, etc.), and an interface, -- having -- **** -- a trunk-line data service network 10 -- minding -- all components -- respectively -- ** -- it connects mutually possible [a communication link].

[0044] This whole system management equipment 8 can record the above-mentioned management information of a subsystem 2--6 sent through a trunk-line data service network 10 from processing-time prediction equipment 9, respectively while managing the management information and the trunk-line data service network 10 grade of the HIS 1 whole.

[0045] processing-time prediction equipment 9 consists of hardware, such as CPU which is not illustrated, memory, stores (a magnetic disk, optical disk unit, etc.), and an interface, -- having -- **** -- a trunk-line data service network 10 -- minding -- all components -- respectively -- ** -- it connects mutually possible [a communication link].

[0046] This processing-time prediction equipment 9 can choose [from] a proper time amount predictive model among [above] plurality according to these contents of a demand etc., when two or more predetermined time amount predictive models (for example, "model based on a queuing network" etc. explained below) are beforehand held in a store or memory and a time amount prediction demand is directed through a trunk-line data service network 10 from terminal 2b of the arbitration in the order ring system 2.

[0047] Selection of this time amount predictive model is performed based on the predetermined conversion table showing the correspondence relation of the contents of a demand and the time amount predictive model of, choosing as time amount prediction processing concerning a certain kind of image inspection "the model based on a queuing network" explained below for example, and choosing another model as another time amount prediction processing etc. If this time amount predictive model is chosen, based on the parameter adjustable algorithm corresponding to the selected model, processing-time prediction equipment 9 will predict the processing times, such as inspection of a referent, and will return this prediction result to directions terminal 2b in the order ring system 2.

[0048] Moreover, this processing-time prediction equipment 9 is all subsystem management equipment 2a of the operating section in connection with inspection of a referent etc. in the case of prediction of the above-mentioned processing time. -- To 6a, the information about the employment condition of a system required for time amount prediction etc. is required, and the information answered and sent to this demand is set up as a parameter of a time

amount predictive model.
[0049] Next, the outline of processing of the time amount prediction by the HIS is explained by making business of radiology into an example. First, the outline of radiology business is explained based on drawing 3 focusing on a patient and an information flow.
[0050] First, if a patient visits the hospital and foreign reception is finished, he will stand by in the waiting room of a consultation room etc. until sequence comes. Subsequently, if it becomes the sequence of a medical examination, a patient will go into a consultation room and will receive the medical examination by the medical practitioner. Termination of this medical examination sends an image inspection request of a patient to radiology reception from a consultation room.
[0051] Subsequently, if a patient moves to radiology reception from a consultation room and reception of image inspection is finished here, he will stand by in the waiting room of radiology until sequence comes. Subsequently, if it becomes the sequence of this image inspection, a patient will go into a laboratory and will undergo the image inspection by the radiology engineer. This image inspection is conducted in accordance with the contents of the inspection request sent to the terminal of a laboratory through the terminal of radiology reception. After this image inspection is completed, a patient returns from radiology to the waiting room of a consultation room etc., and he stands by until the sequence of a therapy comes.
[0052] At this time, the operation information on image inspection is sent to the terminal of accounting through radiology reception from the terminal of a laboratory. Moreover, although sent to the terminal of an interpretation-of-radiogram room from the terminal of an image laboratory, after the interpretation of radiogram is not immediately done by the radiogram-reading doctor of an interpretation-of-radiogram room but waiting for sequence, the interpretation of radiogram of the inspection results, such as a medical image generated in image inspection of a patient. will be carried out. Subsequently, termination of the interpretation of radiogram sends interpretation-of-radiogram results, such as a view report, to the terminal of a consultation room from the terminal of an interpretation-of-radiogram room. [0053] Subsequently, if it becomes the sequence of a therapy, a patient will go into a consultation room again and will undergo the therapy by the medical practitioner. This therapy is performed based on the medical examination result finished beforehand. the interpretation-of-radiogram result of image inspection, etc. After this therapy is completed, a patient will pay on accounting and will come out of a hospital.
[0054] Next, the outline of the time amount prediction processing about the inspection request to radiology is explained based on drawing 4 .
[0055] first, processing-time prediction equipment 9 -- the demand of the time amount prediction from the order ring system 2 -- receiving (step 50) -- information, such as the information about the employment condition of a system required for time amount prediction, for example, an average demand arrival rate, the average processing time, the current waiting number for a demand, and system system operating status, is required from the radiology system 2 (step 51).
[0056] subsequently, the information about the employment condition of a system current from the radiology system 2 -- receiving (step 52) -- based on the contents of a demand and the system system operating status of time-amount prediction which were directed, the optimal model is chosen out of two or more predetermined time-amount predictive models currently held beforehand (step 53), and the information sent to the selected time amount predictive model from the radiology system 2 is set up as a parameter (step 54).
[0057] subsequently, the processing time of the inspection business demanded based on the parameter adjustable algorithm (for example, queue simulator) corresponding to the selected model -- asking (step 55) -- this processing-time result is sent to the order ring system 2 (step 56).
[0058] Here. the outline of a model based on a queuing network (for example, the Yoneda ** "proper use of a discrete system simulation and its alien-system evaluation technique", measurement and a technique, Vol.30, No.2, 1992.2, reference) is explained as an example of the above-mentioned time amount predictive model based on drawing 5 .
[0059] First, the average demand arrival rate of the information about the employment condition of a system, the average processing time, and three kinds of information on the waiting number for a demand are set to the model based on a queuing network as a parameter.
[0060] It asks by carrying out counting of the number of request demands within the arbitration time amount which an "average demand arrival rate" is the number of demands per unit time amount, for example, arrives in a subsystem through a trunk-line data service network with subsystem management equipment. Supposing it makes unit time amount into 1 minute and 60 demands arrive in 1 hour, an average demand arrival rate will become a part

for 60-piece / 60 minute = one-piece/.
[0061] The "average processing time" is the time amount which processing of one demand takes, for example, in the case of a radiology system 3, the time amount which inspection (processing) of one inspection request demand takes is found by calculating the difference (namely, the time amount required by the input of the inspection implementation result at the time of inspection termination from the input of the patient check at the time of inspection initiation) of the actuation time of day inputted into a laboratory terminal at subsystem management equipment 3 a.
[0062] Similarly, the processing time of one demand is found about other subsystems. Therefore, if the processing time of the number of arbitration demands is calculated by continuing, the average processing time can be found. It corrects, for example, in the case of the radiology system 2, there are reception, inspection, and two or more work of the interpretation of radiogram, but when there is two or more work over one demand in this way, it is good also as the processing time [as opposed to one demand for the processing time which could find the processing time for every work on the other hand summarized processing of two or more work according to the time amount predictive model chosen]. Moreover, when subdivisible, you may make it one task find the processing time for every subdivided contents according to the contents. For example, it is also possible to find the processing time for every contents of inspection.
[0063] "The waiting number for a demand" is the number of the demand which waits for processing before processing, for example, in the case of an inspection demand, the waiting number for a demand is called for by subtracting the number of demands which finished inspection from the number of demands which finished reception, and the number of demands under inspection.
[0064] However, since it is dependent on the contents of the time amount predictive model, a parameter required for time amount prediction can acquire processing-time prediction equipment from subsystem management equipment suitably according to the contents of the time amount predictive model also about the information about the employment condition of a system different from the three above-mentioned kinds of information. Moreover, you may assume that the above-mentioned average demand arrival rate and the average processing time are changed stochastic.
[0065] Here, the outline of a model based on the queuing network which applied the above-mentioned average demand arrival rate, the average processing time, and the waiting number for a demand to the parameter is explained based on drawing 5 .
[0066] It shall apply in order to solve time relation until processing of a demand ends through a waiting state from generating of demands between the sides which carry out processing the side which requires processing for this model as this model solves the time relation between the sides which offer service the side which generally receives service and shows it to drawing 5 in this example (request), such as an inspection request.
[0067] For example, the condition of processing standby of the side which processes, and the condition of processing implementation will be doubled, and it will be called a station, and thinks predicting the time amount required by coming out of the demand of the side which requires processing going into a station (processing termination) (demand generating).
[0068] First, in the state of the processing standby in a station, the inspection demand (white round head in drawing 5) equivalent to the waiting number for a demand (the inside of drawing 5 five pieces) has constituted the matrix to a demand chronological order, and it will be in the condition of processing implementation in order from the head of a matrix for every average processing time, and after processing is completed, suppose that it goes away from a station.
[0069] Here, when the inspection demand which attached the mark as a candidate for prediction newly goes into a station, this inspection demand will be attached to the last of a matrix.
[0070] The access time to the station of this inspection demand is decided by the value of the above-mentioned parameter. That is, by the side, a new inspection demand will be entered and located in a line in a station one after another for every average demand arrival rate after the matrix in a station, and on the other hand, at the head side of the matrix of a station, when the inspection demand under processing implementation comes out a station for every average processing time, it will be in the condition of processing implementation of the inspection demand of a matrix head.
[0071] Thus, the time amount taken for the time amount taken [after the inspection demand for prediction goes into a station] to come to the head of a matrix to come out of a station by adding the average processing time to this processing latency time as the processing latency time. i.e., processing end time, will be predicted.
[0072] Then, processing (in this case, it is also called a discrete system simulation) of processing-time prediction in

which the parameter adjustable algorithm built corresponding to the model based on the above-mentioned queuing network was met is explained based on drawing 6 .

[0073] First, when the time-of-day counter in processing-time prediction equipment 9 is initialized at step 60, it is subsystem management equipment 2a at step 61. -- The average processing time and the waiting number for a demand which were received from 6a are set up as the processing time of a station, and a processor-limited demand (number). Subsequently, the inspection demand which attached the mark as a candidate for prediction at step 62 is added to the last of a queue.

[0074] Subsequently, a time-of-day counter has it judged at step 64 by step 63 whether it is time-of-day counter = "the integral multiple of average demand arrival spacing", when only unit time amount (for example, 1 minute) is added. If judged as YES at this step 64, one inspection demand will be added to the last of the queue of a station at step 65, and it will shift to step 66, and on the other hand, if judged as NO at step 64, it will shift to step 66.

[0075] Subsequently, it is judged at step 66 whether it is time-of-day counter = "the time of day showing the integral multiple of the average processing time." If judged as YES at step 66, it will shift to step 67, and on the other hand, when judged as NO at step 66, processing of a return top Norikazu ream will be repeated to step 63.

[0076] Subsequently, it is judged whether the head of a queue has the inspection demand which attached the mark at step 67. If judged as YES at step 67, it will shift to step 69, and on the other hand, when judged as NO at step 67, the inspection demand of the head of the queue of a station will be deleted at step 68, and processing of a return top Norikazu ream will be repeated to step 63.

[0077] Subsequently, it considers as the processing latency time which has the value of a time-of-day counter predicted at step 69. Moreover, processing end time is found by adding the average processing time to this processing latency time.

[0078] In addition, although the above-mentioned procedure is an example of the procedure of finding the processing time by the so-called discrete time system SHIMYURESHUN on the other hand, queuing-network analysis (for example, "Quantitative System Performance Computer System Analysis UsingQueueing Network Models" --) Edward D.Lazowska, John You may be the procedure for which it asks by continuous system SHIMYURESHUN using algebra, such as Zahorjan, Prentice-Hall, Inc., reference, and a differentiation equation.

[0079] Moreover, although the above-mentioned time amount predictive model is based on the queuing network On the other hand, the model using the Petri net (for example) "Performance Evaluation ofPicture Archiving and Communication Network Using StocasticActivity Networks", W. H.Sandars R.Martinez IEEE TRANSACTIONON MEDICAL IMAGING, VOL.12, NO.1, MARCH You may be another time amount predictive models, such as 1993 and reference.

[0080] Next, the whole actuation is explained based on drawing 7 .

[0081] Here, in case you direct an inspection request from the medical practitioner of a consultation room to radiology, suppose that inspection end time is predicted.

[0082] First, in case an image inspection request is taken out to radiology, an inquiry demand of the processing times, such as inspection end time, is advanced from terminal 2b in the order ring system 2 by processing-time prediction equipment 9 by the alter operation of the medical practitioner of a consultation room (step 70).

[0083] Then, if an inquiry demand is received through a trunk-line data service network 10, this prediction equipment 9 will interpret the contents of this demand (step 71), and will ask subsystem management equipment 3a of the radiology system 3 the information about the employment condition of a current system required for time amount prediction of a patient waiting state, average inspection time amount, etc. (step 72).

[0084] Then, subsystem management equipment 3a answers the contents of an inquiry, and sends the information about the employment condition of a system required for time amount prediction to processing-time prediction equipment 9 (step 73).

[0085] Then, this prediction equipment 9 is applied to the time amount predictive model which has held the information about the employment condition of a system beforehand, the time amount which inspection takes is predicted (step 74), and this prediction result is returned to directions terminal 2b of the order ring system 2 (step 75). Then, directions terminal 2b of the order ring system 2 displays a prediction result on a screen (step 76).

[0086] The processing times, such as inspection end time in case, as for the HIS concerning the above-mentioned example, a medical practitioner etc. newly demands the request of an inspection request etc., will be automatically predicted by the above.

[0087] The medical practitioner who directs an inspection request etc. based on this prediction result can grasp the confusion situation of trustee business correctly, since he can judge exactly whether it is made an urgent request, an unnecessary urgent request also decreases, the working efficiency of the business of a trustee is improved, and

operation effectiveness of the whole system also comes to improve sharply.
[0088] Moreover, since the time of day which comes out of inspection end time or a hospital beforehand can be known before undergoing inspection etc. also for a patient, a schedule and an action plan after reducing uneasy extent produced since the time amount which inspection of a hospital etc. takes is not known and coming out of a hospital can be formed beforehand.
[0089] In addition, although [the HIS concerning the above-mentioned example] the inspection time amount of image inspection of a radiology system is predicted, it may predict the time amount about the interpretation of radiogram of an image. In this case, the time amount which the interpretation of radiogram takes can be predicted now by setting up the information about the employment condition of systems, such as the number of the waiting images for the interpretation of radiogram, as a parameter. Therefore, in case a medical practitioner requests inspection from radiology, prediction of the time amount taken for the inspection result and interpretation-of-radiogram result about this inspection to return is attained.
[0090] Moreover, the HIS concerning the above-mentioned example may be the configuration of connecting to a radiology system the medical pictorial communication storage system which keeps and communicates the medical image generated by two or more image diagnostic equipment, such as an X-ray CT scanner and MRI equipment, possible [a communication link], and managing the information about operation / failure situation in this medical pictorial communication storage system, or the condition of a system with the subsystem management equipment of a radiology system. In this case, if the information about the employment condition of systems, such as the number of the waiting patients for inspection, is beforehand set up as a parameter about each of two or more image diagnostic equipment, the time amount which the inspection for every image diagnostic equipment takes can be predicted.
[0091] Moreover, although the HIS concerning the above-mentioned example, in addition, predicts the inspection time amount about a radiology system etc., this invention is not limited to this and, of course, prediction of the processing time about work of the subsystem of another operating sections, such as a specimen system, an accounting system, and a reception system, is also possible for it.
[0092] Furthermore, when requiring the request of inspection etc. of each of another subsystem from an order ring system, although [the HIS concerning the above-mentioned example] the processing time is predicted, it is also possible for this invention not to be limited to this and to require prediction of the processing time through processing-time prediction equipment also between each of another subsystem.
[0093]
[Effect of the Invention] If it is in the processing-time prediction system of the hospital business concerning this invention as explained above While the information about the employment condition of a system of having managed the operating information of a hospital is managed Since the time amount which the information about this employment condition is applied to the time amount predictive model currently held beforehand, and will be required by the time of processing termination from the time of the occurrence of a demand of work is predicted automatically, Based on this prediction result, the medical practitioner who directs an inspection request etc. can grasp the confusion situation of trustee business correctly, and can judge now exactly whether it is made an urgent request. An unnecessary urgent request also decreases by this, the working efficiency of the business of a trustee is improved, and the operation effectiveness of the whole system comes to improve sharply. Moreover, since the time of day which comes out of inspection end time or a hospital beforehand can be known before undergoing inspection etc. also for a patient, a schedule and an action plan after mitigating uneasy extent produced since the time amount which inspection of a hospital etc. takes is not known and coming out of a hospital can be formed beforehand.

[Translation done.]

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TECHNICAL FIELD

[Industrial Application] This invention relates to the processing-time prediction system of hospital business, especially manages the operating information on each work, such as medical examination of hospital business, inspection, reception, and accounting, and relates to the processing-time prediction system which applied this operating information to the time amount predictive model.

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PRIOR ART

[Description of the Prior Art] There are usually medical examination carried out by the medical practitioner in a consultation room etc. and business carried out by each specialized staff etc. in each section, such as reception, various inspection, drugs, and accounting, in order to assist this medical examination as business of a hospital. The various information about medicine is transmitted between each of two or more of these operating sections. Generally as a system related to the hospital business for transmitting such information quickly and correctly, the HIS (HIS) is known.

[0003] This HIS consists of two or more terminals which bear I/O of medical information, and each of this terminal is mutually connected possible [a communication link] through the network as an information-transmission way. Moreover, each of this terminal is installed in each operating section, such as reception of a hospital, a consultation room, various laboratories, and accounting, as an I/O device of various medical information.

[0004] Among the various medical information outputted and inputted from two or more above-mentioned terminals, the request information of the request of the request to a consultation room from reception, the inspection request to various laboratories [medical practitioner / of a consultation room], drugs preparation, etc. will be sent to the terminal of trustee business (inspection etc.) through a network by being inputted from the terminal of requesting agency business (medical examination etc.). This transmitted request information includes the contents which direct the work breakdown of a trustee concretely, for example, an inspection class etc., and these contents will be displayed on the screen of the terminal of a trustee. Thereby, at a trustee, while processing inspection etc. in accordance with the contents of a request by which a screen display was carried out to the terminal, it returns to the terminal of a requesting agency through a network by inputting the information on this carried-out processing result from a terminal.

[0005] Here, the outline in the case of carrying out an inspection request is explained to the radiology section which bears various image inspection from the medical practitioner of a consultation room as an example of the above-mentioned request signal transduction.

[0006] First, if a medical practitioner inputs an inspection request of a patient into a terminal, this request information will be sent to radiology through a network. At this time, a medical practitioner judges whether based on confusion situations, such as a waiting state of the patient in a trustee, and the unsettled number of requests, the time amount from which an inspection result is obtained is expected experientially, this anticipation time amount is considered, and it is urgently made a request, or it is usually made a request.

[0007] Subsequently, in radiology, if arrival of a patient is checked and reception of a patient is performed, image inspection by the radiology engineer will be carried out. This image inspection is conducted according to the inspection class of the request information, the contents of inspection, etc. This inspection result is sent to the terminal of a radiology interpretation-of-radiogram room with request information. At this time, the name of patient of the inspection information, an inspection class, the contents of inspection, etc. are sent also to the terminal of accounting.

[0008] Subsequently, at a radiology interpretation-of-radiogram room, the interpretation of radiogram of the inspection result is done by the radiogram-reading doctor, and this interpretation-of-radiogram result is summarized as an interpretation-of-radiogram report. The interpretation-of-radiogram information on this interpretation-of-radiogram report is sent to the terminal of a requesting agency through a network with inspection information from the terminal of radiology. At this time, the inspection fee is calculated at the terminal of accounting based on the above-mentioned inspection information.

[0009] Subsequently, in a requesting agency, a sick diagnosis of the patient by the medical practitioner and a therapy are performed based on the inspection information and interpretation-of-radiogram information which have

been sent from radiology.

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EFFECT OF THE INVENTION

[Effect of the Invention] If it is in the processing-time prediction system of the hospital business concerning this invention as explained above While the information about the employment condition of a system of having managed the operating information of a hospital is managed Since the time amount which the information about this employment condition is applied to the time amount predictive model currently held beforehand, and will be required by the time of processing termination from the time of the occurrence of a demand of work is predicted automatically, Based on this prediction result, the medical practitioner who directs an inspection request etc. can grasp the confusion situation of trustee business correctly, and can judge now exactly whether it is made an urgent request. An unnecessary urgent request also decreases by this, the working efficiency of the business of a trustee is improved, and the operation effectiveness of the whole system comes to improve sharply. Moreover, since the time of day which comes out of inspection end time or a hospital beforehand can be known before undergoing inspection etc. also for a patient, a schedule and an action plan after mitigating uneasy extent produced since the time amount which inspection of a hospital etc. takes is not known and coming out of a hospital can be formed beforehand.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, since the operating information about medicine, such as an inspection request, was transmitted to each of two or more operating sections not through a help but through a network in the HIS of the conventional technique mentioned above, it was difficult to grasp the confusion situation in another operating section, i.e., the unsettled number of requests which changes with time, a patient's waiting state, etc.

[0011] If it was in the HIS synthesizing various medical information when the above-mentioned confusion situation consisted of two or more processings especially for example, for a certain reason, it was very difficult for a confusion situation to occur in each of two or more processings to grasp each of this confusion situation correctly.

[0012] As mentioned above, although it was difficult to grasp the confusion situation of another operating section, the medical practitioner needs to grasp the confusion situation of trustee business as much as possible, in order to judge whether it is usually made a request or it is urgently made a request, and needed to expect the time amount which work of trustee business takes. For example, since a medical practitioner was not able to recognize the confusion situation of trustee business, namely, was hardly able to expect end time of work of trustee business, even if he usually actually issued the request, he might take out the request also with the time of the confusion situation which is generous enough in time urgently.

[0013] When the above-mentioned unnecessary urgent request arose, while the operation effectiveness of the HIS fell, there was a trouble that the working capacity of trustee business will also fall, consequently a patient's diagnostic effectiveness etc. will fall.

[0014] Moreover, it was set to one [as opposed to / for a patient / inspection] of the sources of anxiety that the time amount which inspection takes is unknown.

[0015] This invention aims at offering the time amount prediction system of beforehand acquirable hospital business for the processing time which inspection etc. takes while it was made in consideration of the problem of the conventional technique mentioned above and can grasp the confusion situation of hospital business correctly.

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MEANS

[Means for Solving the Problem] In order to attain the above-mentioned purpose, the processing-time prediction system of the hospital business concerning invention according to claim 1 It has two or more elements which can output and input the operating information about each of two or more work assigned according to the work breakdown of a hospital. Connect each of two or more of these elements mutually possible [a communication link], and it considers as the configuration which managed the above-mentioned operating information. A system management means to manage the information about the employment condition of the above-mentioned system of the above-mentioned operating information which includes the information on processing of two or more above-mentioned work, and management at least, The information on the above-mentioned processing managed by this system management means and management was applied to at least one time amount predictive model currently held beforehand, and it has a processing-time prediction means to predict the time amount to be required by the time of processing termination from the time of demand generating when requiring processing of the above-mentioned work newly.

[0017] Moreover, in invention according to claim 2, said processing-time prediction means was built corresponding to said time amount predictive model, and is a parameter adjustable algorithm and is equipped with a means to set up the information on said processing and management as the parameter.

[0018] Moreover, in invention according to claim 3, the information on said processing and management contains the number of demands which is in each demand incidence rate, the demand processing time, and the waiting state of work of said plurality at least.

[0019] Moreover, in invention according to claim 4, said time amount predictive model is a model based on a queuing network at least.

[0020] Moreover, in invention according to claim 5, said two or more elements contain the terminal unit at least.

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OPERATION

[Function] If it is in invention according to claim 1, while the information about the employment condition of the system of the operating information which includes the information on processing of two or more above-mentioned work and management at least is managed by the system management means By the processing-time prediction means, the information on processing and management is applied to at least one time amount predictive model currently held beforehand, and the time amount to be required by the time of processing termination from the time of demand generating when requiring processing of work newly is predicted.
[0022] Moreover, in invention according to claim 2, it is built corresponding to the above-mentioned time amount predictive model, and the information on processing of two or more work and management is set up as the parameter by the processing-time prediction means as a parameter adjustable algorithm.
[0023] For example, in invention according to claim 3, the information containing the number of demands in each demand incidence rate, the demand processing time, and the waiting state of two or more work is set up as a parameter of the above-mentioned time amount predictive model.
[0024] Moreover, in invention according to claim 4, the model based on a queuing network is beforehand held as one of the time amount predictive models.
[0025] Moreover, in invention according to claim 5, operating information is outputted and inputted among two or more elements which contain a terminal unit at least.

[Translation done.]

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EXAMPLE

[Example] Hereafter, one example of this invention is explained with reference to drawing 1 - drawing 7 . In addition, this one example carries and carries out the time amount prediction system of the hospital business concerning this invention to the HIS.

[0027] Two or more subsystems 2--6 with which HIS 1 shown in drawing 1 is formed in each of the operating section in a hospital, The database equipment 7 which saves patient information etc. and is managed, and the whole system management equipment 8 which constitutes a part of system management means of this invention (TSM), It consists of processing-time prediction equipment (it is also called a simulator (SMLT)) 9 which constitutes the processing-time prediction means of this invention, and each of this component is mutually connected possible [a communication link] through the trunk-line data service networks 10, such as LAN.

[0028] A subsystem 2--6 consists of the order ring system 2 which manages a patient's clinical information, the radiology system 3 which manages a patient's image inspection information, a specimen system 4 which manages a patient's laboratory test information, an accounting system 5 which manages the accounting information in a hospital, and a reception system 6 which manages an outpatient's reception information etc.

[0029] Each of this subsystem 2--6 consists of two or more terminals connected to the network for subsystems, such as LAN, (it is hereafter called a branch line network), and the subsystem management equipment (SSM) as an important section of the system management means of this invention (refer to drawing 2).

[0030] The order ring systems 2 are two or more terminal 2bs which are the systems which manage a patient's clinical information and take out directions of an inspection request etc. to each operating section, and are arranged in a consultation room, a ward, etc. -- It consists of 2b and subsystem management equipment (SSMO) 2a which supervises the information about the employment condition of this system 2 etc. another component connected to a trunk-line data service network 10 through the gateway for communications protocol conversion (not shown) while each of this component is mutually connected possible [a communication link] through the branch line network (not shown) -- respectively -- ** -- it can communicate mutually.

[0031] Two or more terminal 2bs -- Each of 2b consists of hardware, such as CPU which is not illustrated, memory, stores (a magnetic disk, optical disk unit, etc.), and an interface. By this hardware configuration, it is terminal 2b. -- Each of 2b has come to be able to carry out a screen display to terminal [which sends directions of an inspection request, such as a laboratory test and image inspection, to the subsystem of a trustee through a trunk-line data service network 10 from terminal 2b of arbitration] 2b which both received this request result and inputted directions by alter operation, such as a medical practitioner or a nurse. Moreover, terminal 2b -- When a medical practitioner etc. issues directions of an inspection request, each of 2b receives the prediction result of this inspection end time, and has come to be able to carry out a screen display to terminal 2b which carried out the directions input by sending directions of a time amount prediction demand to time amount prediction equipment 9 through a trunk-line data service network 10.

[0032] Subsystem management equipment (SSMO) 2a consists of hardware, such as CPU which is not illustrated, memory, stores (a magnetic disk, optical disk unit, etc.), and an interface. By this hardware configuration, subsystem management equipment 2a The condition of the demand directed through a trunk-line data service network 10, terminal 2b in the order ring system 2 -- While supervising the employment condition of the system 2 which changes every moment with time [a processing state including each input of 2b, operation / failure situation, etc.] When there is a demand of reference etc. to the information about the employment condition of this system 2 from each of all the components connected to a trunk-line data service network 10, it answers information about employment condition of system in this time demand-origin.

[0033] The radiology system 3 is two or more terminal 3b usually arranged at a radiology reception room, an image

laboratory, an interpretation-of-radiogram room, etc. as it is the system which manages the text about image inspection carried out by various kinds of image diagnostic equipment (an X-ray CT scanner, MRI equipment, etc.) of radiology and is shown in drawing 2 . -- It consists of 3b and subsystem management equipment (SSMR) 3a which manages the information about the employment condition of this system 3 etc. Each of this component can communicate to each of all the components connected to a trunk-line data service network 10 through gateway 3d for communications protocol conversion, and mutual while connecting mutually possible [a communication link] through branch line network 3c.

[0034] A terminal is 3b respectively. -- 3b consists of hardware, such as CPU which is not illustrated, memory, stores (a magnetic disk, optical disk unit, etc.), and an interface. By this hardware configuration, it is terminal 3b. -- If directions of an image inspection request are received from terminal 2b of the arbitration in the order ring system 2, each of 3b will return information, such as an operation result of directed image inspection, and an interpretation-of-radiogram result, to terminal 2b of the request origin in the order ring system 2 through a trunk-line data service network 10 by actuation of a radiology medical practitioner or the staff while it displays the contents of an inspection request on a screen.

[0035] This terminal 3b -- If an example of each arrangement configuration of 3b is explained, by terminal 3b arranged at a radiology reception room, the screen display of the contents of an inspection request directed from terminal 2b of the arbitration in the order ring system 2 and registration of a candidate patient's patient information will mainly be performed first. Moreover, in terminal 3b of an image laboratory, while carrying out a screen display of the patient information registered at the terminal of the contents of an inspection request, and a radiology reception room by actuation of the radiology engineer who carries out image inspection, an inspection implementation result can be inputted. Furthermore, in terminal 3b of an interpretation-of-radiogram room, while carrying out a screen display of the inspection implementation result inputted in the contents of an inspection request, patient information, and an image laboratory by actuation of the medical practitioner who performs the interpretation of radiogram, the interpretation-of-radiogram result of the medical image obtained by image inspection can be inputted.

[0036] Subsystem management equipment (SSMR) 3a consists of hardware, such as CPU which is not illustrated, memory, stores (a magnetic disk, optical disk unit, etc.), and an interface. By this hardware configuration, subsystem management equipment 3a Terminal 3b in the condition of the demand directed through a trunk-line data service network 10, and this system 3 -- While supervising the employment condition of the system 3 which changes every moment with time [a processing state including each input of 3b, operation / failure situation, etc.] When there is a demand of reference etc. to the information about the employment condition of this system 3 from each of all the components connected to a trunk-line data service network 10, it answers information about employment condition of system at this time demand-origin.

[0037] The specimen system 4 is a system which manages a patient's laboratory test information, and consists of two or more terminals (not shown) arranged at a laboratory test room etc., and subsystem management equipment (SSMC) 4a. Each of this component can communicate to each of all the components connected to a trunk-line data service network 10 through the gateway for communications protocol conversion (not shown), and mutual while connecting mutually possible [a communication link] through the branch line network.

[0038] Each of a terminal consists of hardware, such as CPU which is not illustrated, memory, stores (a magnetic disk, optical disk unit, etc.), and an interface. Information, such as an operation result of the laboratory test directed by this hardware configuration while displaying the contents of an inspection request on the screen by the staff's etc. actuation when each of a terminal received directions of a laboratory test request from terminal 2b of the arbitration in the order ring system 2, is returned to terminal 2b of the request origin in the order ring system 2 through a trunk-line data service network 10.

[0039] Subsystem management equipment (SSMC) 4a consists of hardware, such as CPU which is not illustrated, memory, stores (a magnetic disk, optical disk unit, etc.), and an interface. By this hardware configuration, subsystem management equipment 4a While supervising the employment condition of the system 4 which changes every moment with time [the condition of the demand directed through a trunk-line data service network 10, a processing state including each input of the terminal in the specimen system 4, operation / failure situation, etc.] When there is a demand of reference etc. to the information about the employment condition of this system 4 from each of all the components connected to a trunk-line data service network 10, it answers information about employment condition of system at this time demand-origin.

[0040] An accounting system 5 is a system which manages the accounting information in a hospital, and consists of two or more terminals (not shown) arranged at an accounting room etc., and subsystem management equipment

(SSMK) 5a. Each of this component can communicate to each of all the components connected to a trunk-line data service network 10 through the gateway for communications protocol conversion (not shown), and mutual while connecting mutually possible [a communication link] through the branch line network. This accounting system 5 can calculate tariffs, such as an inspection fee, now from operation information, such as various inspection sent through a trunk-line data service network 10.

[0041] The reception system 6 is a system which receives an outpatient, and consists of two or more terminals (not shown) arranged at outpatient department reception etc., and subsystem management equipment (SSMU) 6a. Each of this component can communicate to each of all the components connected to a trunk-line data service network 10 through the gateway for communications protocol conversion (not shown), and mutual while connecting mutually possible [a communication link] through the branch line network (not shown). This reception system 6 sends reception information, such as an outpatient, to order ring system 2 grade through a trunk-line data service network 10.

[0042] Database equipment 7 consists of hardware, such as CPU which is not illustrated, memory, stores (a magnetic disk, optical disk unit, etc.), and an interface, and is connected to each of all the components connected through a trunk-line data service network 10, and mutual possible [a communication link]. By these configurations, proper medical information, such as patient information (a name of patient, sex, etc.) treated within HIS 1, is saved, and this database equipment 7 can manage it now. Moreover, if the demand of reference etc. is received from each of the above-mentioned component connected to a trunk-line data service network 10, this database equipment 7 will answer this demand, and will return reference information to each of the above-mentioned component of a requiring agency.

[0043] whole system management equipment 8 consists of hardware, such as CPU which is not illustrated. memory, stores (a magnetic disk, optical disk unit, etc.), and an interface, -- having -- **** -- a trunk-line data service network 10 -- minding -- all components -- respectively -- ** -- it connects mutually possible [a communication link].

[0044] This whole system management equipment 8 can record the above-mentioned management information of a subsystem 2--6 sent through a trunk-line data service network 10 from processing-time prediction equipment 9, respectively while managing the management information and the trunk-line data service network 10 grade of the HIS 1 whole.

[0045] processing-time prediction equipment 9 consists of hardware, such as CPU which is not illustrated, memory, stores (a magnetic disk, optical disk unit, etc.), and an interface, -- having -- **** -- a trunk-line data service network 10 -- minding -- all components -- respectively -- ** -- it connects mutually possible [a communication link].

[0046] This processing-time prediction equipment 9 can choose [from] a proper time amount predictive model among [above] plurality according to these contents of a demand etc., when two or more predetermined time amount predictive models (for example, "model based on a queuing network" etc. explained below) are beforehand held in a store or memory and a time amount prediction demand is directed through a trunk-line data service network 10 from terminal 2b of the arbitration in the order ring system 2.

[0047] Selection of this time amount predictive model is performed based on the predetermined conversion table showing the correspondence relation of the contents of a demand and the time amount predictive model of, choosing as time amount prediction processing concerning a certain kind of image inspection "the model based on a queuing network" explained below for example, and choosing another model as another time amount prediction processing etc. If this time amount predictive model is chosen, based on the parameter adjustable algorithm corresponding to the selected model, processing-time prediction equipment 9 will predict the processing times, such as inspection of a referent, and will return this prediction result to directions terminal 2b in the order ring system 2.

[0048] Moreover, this processing-time prediction equipment 9 is all subsystem management equipment 2a of the operating section in connection with inspection of a referent etc. in the case of prediction of the above-mentioned processing time. -- To 6a, the information about the employment condition of a system required for time amount prediction etc. is required, and the information answered and sent to this demand is set up as a parameter of a time amount predictive model.

[0049] Next, the outline of processing of the time amount prediction by the HIS is explained by making business of radiology into an example. First, the outline of radiology business is explained based on drawing 3 focusing on a patient and an information flow.

[0050] First, if a patient visits the hospital and foreign reception is finished, he will stand by in the waiting room of a consultation room etc. until sequence comes. Subsequently, if it becomes the sequence of a medical examination,

a patient will go into a consultation room and will receive the medical examination by the medical practitioner. Termination of this medical examination sends an image inspection request of a patient to radiology reception from a consultation room.

[0051] Subsequently, if a patient moves to radiology reception from a consultation room and reception of image inspection is finished here, he will stand by in the waiting room of radiology until sequence comes. Subsequently, if it becomes the sequence of this image inspection, a patient will go into a laboratory and will undergo the image inspection by the radiology engineer. This image inspection is conducted in accordance with the contents of the inspection request sent to the terminal of a laboratory through the terminal of radiology reception. After this image inspection is completed, a patient returns from radiology to the waiting room of a consultation room etc., and he stands by until the sequence of a therapy comes.

[0052] At this time, the operation information on image inspection is sent to the terminal of accounting through radiology reception from the terminal of a laboratory. Moreover, although sent to the terminal of an interpretation-of-radiogram room from the terminal of an image laboratory, after the interpretation of radiogram is not immediately done by the radiogram-reading doctor of an interpretation-of-radiogram room but waiting for sequence, the interpretation of radiogram of the inspection results, such as a medical image generated in image inspection of a patient, will be carried out. Subsequently, termination of the interpretation of radiogram sends interpretation-of-radiogram results, such as a view report, to the terminal of a consultation room from the terminal of an interpretation-of-radiogram room.

[0053] Subsequently, if it becomes the sequence of a therapy, a patient will go into a consultation room again and will undergo the therapy by the medical practitioner. This therapy is performed based on the medical examination result finished beforehand, the interpretation-of-radiogram result of image inspection, etc. After this therapy is completed, a patient will pay on accounting and will come out of a hospital.

[0054] Next, the outline of the time amount prediction processing about the inspection request to radiology is explained based on drawing 4 .

[0055] first, processing-time prediction equipment 9 -- the demand of the time amount prediction from the order ring system 2 -- receiving (step 50) -- information, such as the information about the employment condition of a system required for time amount prediction, for example, an average demand arrival rate, the average processing time, the current waiting number for a demand, and system system operating status, is required from the radiology system 2 (step 51).

[0056] subsequently, the information about the employment condition of a system current from the radiology system 2 -- receiving (step 52) -- based on the contents of a demand and the system system operating status of time-amount prediction which were directed, the optimal model is chosen out of two or more predetermined time-amount predictive models currently held beforehand (step 53), and the information sent to the selected time amount predictive model from the radiology system 2 is set up as a parameter (step 54).

[0057] subsequently, the processing time of the inspection business demanded based on the parameter adjustable algorithm (for example, queue simulator) corresponding to the selected model -- asking (step 55) -- this processing-time result is sent to the order ring system 2 (step 56).

[0058] Here, the outline of a model based on a queuing network (for example, the Yoneda ** "proper use of a discrete system simulation and its alien-system evaluation technique", measurement and a technique, Vol.30, No.2, 1992.2. reference) is explained as an example of the above-mentioned time amount predictive model based on drawing 5 .

[0059] First, the average demand arrival rate of the information about the employment condition of a system, the average processing time, and three kinds of information on the waiting number for a demand are set to the model based on a queuing network as a parameter.

[0060] It asks by carrying out counting of the number of request demands within the arbitration time amount which an "average demand arrival rate" is the number of demands per unit time amount, for example, arrives in a subsystem through a trunk-line data service network with subsystem management equipment. Supposing it makes unit time amount into 1 minute and 60 demands arrive in 1 hour, an average demand arrival rate will become a part for 60-piece / 60 minute = one-piece/.

[0061] The "average processing time" is the time amount which processing of one demand takes, for example, in the case of a radiology system 3, the time amount which inspection (processing) of one inspection request demand takes is found by calculating the difference (namely, the time amount required by the input of the inspection implementation result at the time of inspection termination from the input of the patient check at the time of inspection initiation) of the actuation time of day inputted into a laboratory terminal at subsystem management

equipment 3 a.
[0062] Similarly, the processing time of one demand is found about other subsystems. Therefore, if the processing time of the number of arbitration demands is calculated by continuing, the average processing time can be found. It corrects. for example, in the case of the radiology system 2, there are reception, inspection, and two or more work of the interpretation of radiogram, but when there is two or more work over one demand in this way, it is good also as the processing time [as opposed to one demand for the processing time which could find the processing time for every work on the other hand summarized processing of two or more work according to the time amount predictive model chosen]. Moreover, when subdivisible, you may make it one task find the processing time for every subdivided contents according to the contents. For example, it is also possible to find the processing time for every contents of inspection.
[0063] "The waiting number for a demand" is the number of the demand which waits for processing before processing, for example, in the case of an inspection demand, the waiting number for a demand is called for by subtracting the number of demands which finished inspection from the number of demands which finished reception, and the number of demands under inspection.
[0064] However, since it is dependent on the contents of the time amount predictive model, a parameter required for time amount prediction can acquire processing-time prediction equipment from subsystem management equipment suitably according to the contents of the time amount predictive model also about the information about the employment condition of a system different from the three above-mentioned kinds of information. Moreover, you may assume that the above-mentioned average demand arrival rate and the average processing time are changed stochastic.
[0065] Here, the outline of a model based on the queuing network which applied the above-mentioned average demand arrival rate, the average processing time, and the waiting number for a demand to the parameter is explained based on drawing 5 .
[0066] It shall apply in order to solve time relation until processing of a demand ends through a waiting state from generating of demands between the sides which carry out processing the side which requires processing for this model as this model solves the time relation between the sides which offer service the side which generally receives service and shows it to drawing 5 in this example (request), such as an inspection request.
[0067] For example, the condition of processing standby of the side which processes, and the condition of processing implementation will be doubled, and it will be called a station, and thinks predicting the time amount required by coming out of the demand of the side which requires processing going into a station (processing termination) (demand generating).
[0068] First, in the state of the processing standby in a station, the inspection demand (white round head in drawing 5) equivalent to the waiting number for a demand (the inside of drawing 5 five pieces) has constituted the matrix to a demand chronological order, and it will be in the condition of processing implementation in order from the head of a matrix for every average processing time, and after processing is completed, suppose that it goes away from a station.
[0069] Here, when the inspection demand which attached the mark as a candidate for prediction newly goes into a station, this inspection demand will be attached to the last of a matrix.
[0070] The access time to the station of this inspection demand is decided by the value of the above-mentioned parameter. That is, by the side, a new inspection demand will be entered and located in a line in a station one after another for every average demand arrival rate after the matrix in a station, and on the other hand, at the head side of the matrix of a station, when the inspection demand under processing implementation comes out a station for every average processing time, it will be in the condition of processing implementation of the inspection demand of a matrix head.
[0071] Thus, the time amount taken for the time amount taken [after the inspection demand for prediction goes into a station] to come to the head of a matrix to come out of a station by adding the average processing time to this processing latency time as the processing latency time, i.e., processing end time, will be predicted.
[0072] Then, processing (in this case, it is also called a discrete system simulation) of processing-time prediction in which the parameter adjustable algorithm built corresponding to the model based on the above-mentioned queuing network was met is explained based on drawing 6 .
[0073] First, when the time-of-day counter in processing-time prediction equipment 9 is initialized at step 60, it is subsystem management equipment 2a at step 61. -- The average processing time and the waiting number for a demand which were received from 6a are set up as the processing time of a station, and a processor-limited demand (number). Subsequently, the inspection demand which attached the mark as a candidate for prediction at step 62 is

added to the last of a queue.
[0074] Subsequently, a time-of-day counter has it judged at step 64 by step 63 whether it is time-of-day counter = "the integral multiple of average demand arrival spacing", when only unit time amount (for example, 1 minute) is added. If judged as YES at this step 64, one inspection demand will be added to the last of the queue of a station at step 65, and it will shift to step 66, and on the other hand, if judged as NO at step 64, it will shift to step 66.
[0075] Subsequently, it is judged at step 66 whether it is time-of-day counter = "the time of day showing the integral multiple of the average processing time." If judged as YES at step 66, it will shift to step 67, and on the other hand, when judged as NO at step 66, processing of a return top Norikazu ream will be repeated to step 63.
[0076] Subsequently, it is judged whether the head of a queue has the inspection demand which attached the mark at step 67. If judged as YES at step 67, it will shift to step 69, and on the other hand, when judged as NO at step 67, the inspection demand of the head of the queue of a station will be deleted at step 68, and processing of a return top Norikazu ream will be repeated to step 63.
[0077] Subsequently, it considers as the processing latency time which has the value of a time-of-day counter predicted at step 69. Moreover, processing end time is found by adding the average processing time to this processing latency time.
[0078] In addition, although the above-mentioned procedure is an example of the procedure of finding the processing time by the so-called discrete time system SHIMYURESHUN on the other hand, queuing-network analysis (for example, "Quantitative System Performance Computer System Analysis UsingQueueing Network Models" -- Edward D.Lazowska, John You may be the procedure for which it asks by continuous system SHIMYURESHUN using algebra, such as Zahorjan, Prentice-Hall, Inc., reference, and a differentiation equation.
[0079] Moreover, although the above-mentioned time amount predictive model is based on the queuing network On the other hand, the model using the Petri net (for example) "Performance Evaluation ofPicture Archiving and Communication Network Using StocasticActivity Networks", W. H.Sandars R.Martinez IEEE TRANSACTIONON MEDICAL IMAGING, VOL.12, NO.1, MARCH You may be another time amount predictive models. such as 1993 and reference.
[0080] Next. the whole actuation is explained based on drawing 7 .
[0081] Here, in case you direct an inspection request from the medical practitioner of a consultation room to radiology, suppose that inspection end time is predicted.
[0082] First, in case an image inspection request is taken out to radiology, an inquiry demand of the processing times. such as inspection end time, is advanced from terminal 2b in the order ring system 2 by processing-time prediction equipment 9 by the alter operation of the medical practitioner of a consultation room (step 70).
[0083] Then, if an inquiry demand is received through a trunk-line data service network 10, this prediction equipment 9 will interpret the contents of this demand (step 71), and will ask subsystem management equipment 3a of the radiology system 3 the information about the employment condition of a current system required for time amount prediction of a patient waiting state, average inspection time amount, etc. (step 72).
[0084] Then, subsystem management equipment 3a answers the contents of an inquiry, and sends the information about the employment condition of a system required for time amount prediction to processing-time prediction equipment 9 (step 73).
[0085] Then, this prediction equipment 9 is applied to the time amount predictive model which has held the information about the employment condition of a system beforehand, the time amount which inspection takes is predicted (step 74), and this prediction result is returned to directions terminal 2b of the order ring system 2 (step 75). Then, directions terminal 2b of the order ring system 2 displays a prediction result on a screen (step 76).
[0086] The processing times, such as inspection end time in case, as for the HIS concerning the above-mentioned example, a medical practitioner etc. newly demands the request of an inspection request etc., will be automatically predicted by the above.
[0087] The medical practitioner who direcis an inspection request etc. based on this prediction result can grasp the confusion situation of trustee business correctly, since he can judge exactly whether it is made an urgent request, an unnecessary urgent request also decreases, the working efficiency of the business of a trustee is improved, and operation effectiveness of the whole system also comes to improve sharply.
[0088] Moreover, since the time of day which comes out of inspection end time or a hospital beforehand can be known before undergoing inspection etc. also for a patient, a schedule and an action plan after reducing uneasy extent produced since the time amount which inspection of a hospital etc. takes is not known and coming out of a hospital can be formed beforehand.
[0089] In addition, although [the HIS concerning the above-mentioned example] the inspection time amount of

image inspection of a radiology system is predicted, it may predict the time amount about the interpretation of radiogram of an image. In this case, the time amount which the interpretation of radiogram takes can be predicted now by setting up the information about the employment condition of systems, such as the number of the waiting images for the interpretation of radiogram, as a parameter. Therefore, in case a medical practitioner requests inspection from radiology, prediction of the time amount taken for the inspection result and interpretation-of-radiogram result about this inspection to return is attained.

[0090] Moreover, the HIS concerning the above-mentioned example may be the configuration of connecting to a radiology system the medical pictorial communication storage system which keeps and communicates the medical image generated by two or more image diagnostic equipment, such as an X-ray CT scanner and MRI equipment, possible [a communication link], and managing the information about operation / failure situation in this medical pictorial communication storage system, or the condition of a system with the subsystem management equipment of a radiology system. In this case, if the information about the employment condition of systems, such as the number of the waiting patients for inspection, is beforehand set up as a parameter about each of two or more image diagnostic equipment, the time amount which the inspection for every image diagnostic equipment takes can be predicted.

[0091] Moreover, although the HIS concerning the above-mentioned example, in addition, predicts the inspection time amount about a radiology system etc., this invention is not limited to this and, of course, prediction of the processing time about work of the subsystem of another operating sections, such as a specimen system, an accounting system, and a reception system, is also possible for it.

[0092] Furthermore, when requiring the request of inspection etc. of each of another subsystem from an order ring system, although [the HIS concerning the above-mentioned example] the processing time is predicted, it is also possible for this invention not to be limited to this and to require prediction of the processing time through processing-time prediction equipment also between each of another subsystem.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The block diagram showing the outline configuration of the HIS carrying the processing-time prediction system of the hospital business concerning this invention.
[Drawing 2] The block diagram showing the outline configuration of the radiology system as a subsystem.
[Drawing 3] Drawing showing the flow of the outline of the request business to radiology.
[Drawing 4] The flow chart of the outline which shows processing of the whole processing-time prediction equipment.
[Drawing 5] Drawing showing the outline of a model based on a queuing network.
[Drawing 6] The flow chart of the outline which shows processing of time amount prediction of processing-time prediction equipment.
[Drawing 7] The flow chart of the outline concerning actuation of the whole example.
[Description of Notations]
1 HIS
2 Order Ring System
2a, 3a -- 6a Subsystem management equipment (the important section of the system management means of this invention is accomplished)
2b -- 2b Terminal
3 Radiology System
3b -- 3b Terminal
3c Branch line network
3d Gateway
4 Specimen System
5 Accounting System
6 Reception System
7 Database Equipment
8 Whole System Management Equipment (a Part of System Management Means of this Invention is Accomplished)

9 Processing-Time Prediction Equipment (Processing-Time Prediction Means of this Invention)
10 Trunk-line Data Service Network

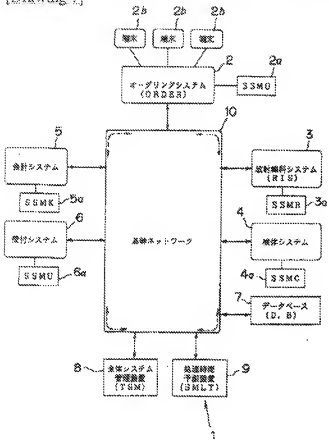
[Translation done.]

* NOTICES *

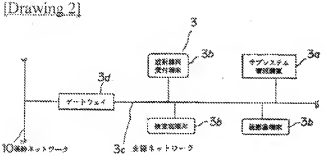
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

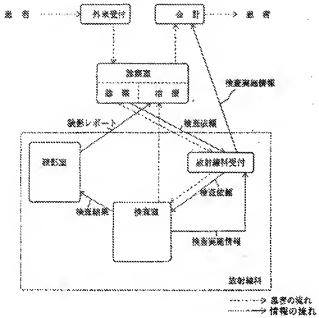
[Drawing 1]



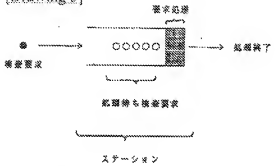
[Drawing 2]



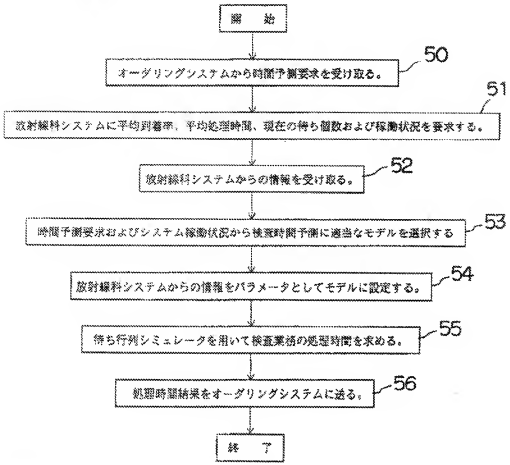
[Drawing 3]



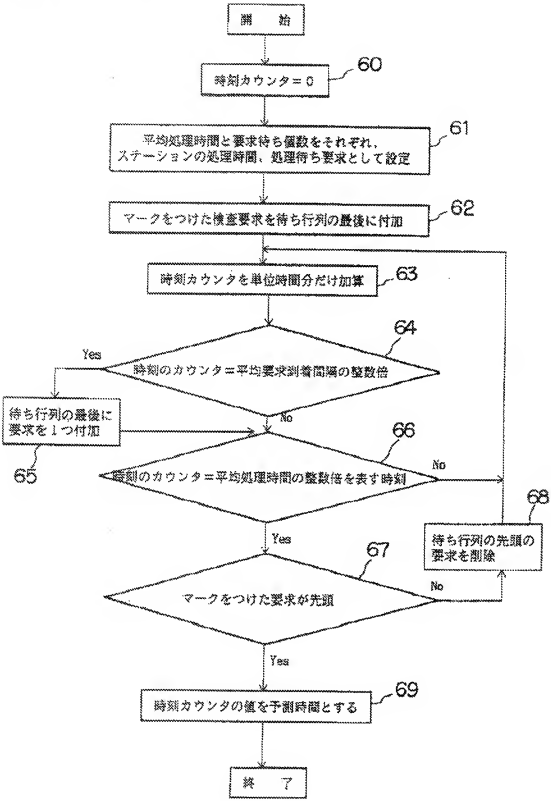
[Drawing 5]



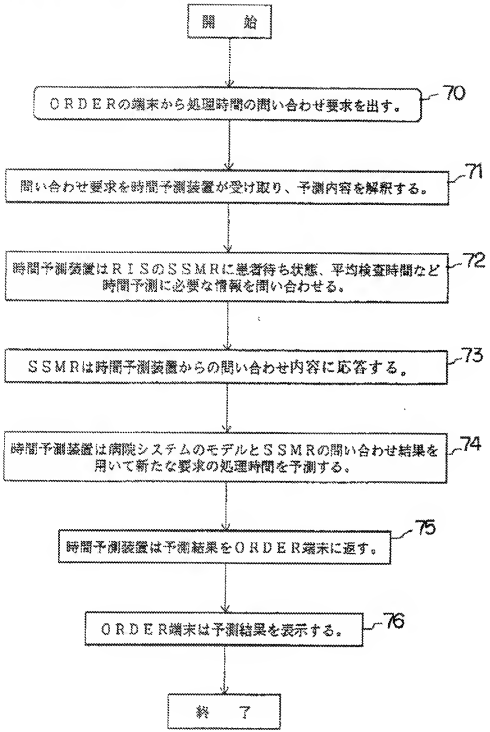
[Drawing 4]


開　始
オーダリングシステムから時間予測要求を受け取る。
50
放射線科システムに平均到着率，平均処理時間、現在の待ち個数および稼働状況を要求する。
51
放射線科システムからの情報を受け取る。
52
時間予測要求およびシステム稼働状況から検査時間予測に適当なモデルを選択する
53
放射線科システムからの情報をパラメータとしてモデルに設定する。
54
待ち行列シミュレータを用いて検査業務の処理時間を求める。
55
処理時間結果をオーダリングシステムに送る。
56
終　了

[Drawing 6]


開　始
時刻カウンタ＝0
60
平均処理時間と要求待ち個数をそれぞれ，ステーションの処理時間，処理待ち要求として設定
61
マークをつけた検査要求を待ち行列の最後に付加
62
時刻カウンタを単位時間分だけ加算
63
時刻のカウンタ＝平均要求到着間隔の整数倍
64
Yes
No
待ち行列の最後に要求を１つ付加
65
時刻のカウンタ＝平均処理時間の整数倍を表す時刻
66
No
Yes
マークをつけた要求が先頭
67
No
待ち行列の先頭の要求を削除
68
Yes
時刻カウンタの値を予測時間とする
69
終　了

[Drawing 7]



[Translation done.]